REMARKS

The Examiner's Office Action of September 17, 2003 has been received and its contents reviewed. Applicant would like to thank the Examiner for the consideration given to the above-identified application, and for indicating the allowance of claim 4.

By the above actions, claims 1, 3, 4 and 8 have been amended, claim 7 has been cancelled and new claim 9 has been added. Claims 5 and 6 were previously withdrawn. Accordingly, claims 1-4, 8 and 9 are pending for consideration, of which claims 1, 3 and 4 are independent. In view of these actions and the following remarks, reconsideration of this application is now requested.

Referring now to the detailed Office Action, claims 1-3 and 7-8 stand rejected under 35 U.S.C. §103(a) as unpatentable over Tichenor et al. (U.S. Patent No. 6,031,598 – hereafter Tichenor) in view of Sakai (U.S. Patent No. 5,466,942 – hereafter Sakai). Further, claims 1-3, 7 and 8 stand rejected under 35 U.S.C. §103(a) as unpatentable over Tichenor in view of Dao et al. (U.S. Patent No. 6,279,249 – hereafter Dao). These rejections are respectfully traversed at least for the reasons provided below.

Independent claims 1, 3 and 8 have been amended to further clarify the present invention. Applicant respectfully submits that none of the references disclose a method for exposing a resist film to extreme ultraviolet radiation through a photomask, from which the deposited film is removed in the second region which is different from the first region within the exposure chamber, after removing the deposited film deposited on a surface of the photomask in the first region therewithin, as recited in the amended claims.

Applicant respectfully submit that none of the references discloses the step of removing the deposited film deposited on the surface of the photomask in a region different from that where the exposure is performed inside the exposure chamber.

The differences between the presently claimed invention and the cited prior art references are set forth below in details.

The present invention relates to a method for removing contaminations from the masks. During the exposure, light emitted from an exposure source is irradiated on the mask before reaching an optical system. The mask is located near to the exposure source in the exposure apparatus. Further, an object of the presently claimed invention resides in defining

a desired pattern with good reproducibility by removing the contaminations deposited on the mask in a vacuum chamber of an EUV exposure apparatus prior to the step of exposing.

The light energy of the introduced light is attenuated little by little while reflection is repeated therein. Thus, the farther the mask is from the exposure apparatus, the greater the light energy reduces. In the present invention, the light, which has been slightly attenuated since it is emitted from the exposure source, is supplied to the mask. As a result, the light having the highest energy while passing through the apparatus is irradiated to the mask.

The contaminations inside the exposure apparatus are generated due to the production of reactants caused by the vaporized gas, which vaporizes from the resist film when irradiated by light. In a region where higher energy is being supplied, more reactants are produced since the gas is vaporized faster. In other words, the contaminations are generated on a surface of the mask on which the light having the highest energy is irradiated. In a chemical reaction caused by irradiating lights to the vaporized gas, the gas partially absorbs the light energy, and the light energy is consumed. As a result, it is difficult to evenly irradiate the lights, and the exposure dose is different among the wafers.

Hence, an object of the present invention is to prevent the contaminations on the mask which most seriously affect the other regions, and thereby effectively preventing the occurrence of contaminations inside the exposure apparatus. As a result, it is possible to decrease the differences of the exposure dose among the wafers, and provide desirable and stable patterns.

Turning to the cited references, Tichenor discloses an extreme ultraviolet lithography machine having a main vacuum chamber 2 comprising a reticle zone which has a reticle stage (see col. 5, lines 11-19). The reticle zone incorporates reticle robotics which permit the changing, cleaning or repair of the reticle while keeping the main chamber uncontaminated (see col. 5, lines 23-25).

Further, Tichenor discloses a method for cleaning the main chamber by using the reticle robotics to avoid being contaminated (see col. 5, lines 22-25). Still further, in Tichenor, the cleaning of the mask is performed outside of the chamber to avoid contaminating the chamber.

Thus, the presently claimed invention is distinguished from Tichenor in view of the place where the cleaning is performed. Moreover, as the Examiner acknowledged, Tichenor

fails to disclose removing the unwanted film from the mask by using oxygen plasma as recited in the presently claimed invention.

Sakai discloses a method for forming patterns by using the charged beam irradiating apparatus (see Abstract), which is different from the exposing method of the present invention. Sakai discloses a charged beam irradiating apparatus having a cleaning means of contaminations within an exposure apparatus and a method for cleaning the contaminations by using oxygen plasma (see col. 2, lines 3-11). However, Sakai fails to disclose a mask. According to the method taught by Sakai, a pattern is directly drawn on a resist film by electron beam (EB).

Applicant respectfully submit that Sakai discloses the cleaning is performed by using oxygen plasma, but not how to clean a mask. Moreover, Sakai fails to suggest or disclose a mask, as well as removing the contaminations on a mask.

Applicant respectfully assert that the combination of Tichenor, which fails to disclose removing the contaminations from the mask, and Sakai, which fails to disclose a mask, does not anticipate the present invention.

In addition, the both Sakai and Tichenor fail to suggest the contamination on the mask and the problem of the occurrence of contaminations during exposure. Hence, the presently claimed invention is not obvious from the combination of the references.

Dao discloses a method for preventing or removing deposits of particles on a reticle while transferring the reticle to an exposure apparatus (see col. 5, lines 32-35). In addition, Dao discloses that the deposits on a mask or a pellicle are removed by using plasma (see col. 3, lines 57-62). However, Dao discloses that the contaminations are generated outside the exposure apparatus. Applicant respectfully assert that no description on occurrence of contaminations within the exposure apparatus is found. In other words, Dao fails to disclose the occurrence of contaminations inside the exposure apparatus and fails to disclose an object of removing the contaminations as recited in the presently claimed invention.

As previously discussed, a feature of the presently claimed invention resides in removing the contaminations deposited on the mask inside the exposure apparatus during exposure. The combination of Tichenor, which fails to disclose the removal of contaminations from the mask, and Dao, which has the object of preventing the intrusion of the particles to the exposure apparatus, does not anticipate the present invention.

The requirements for establishing a *prima facie* case of obviousness, as detailed in MPEP § 2143 - 2143.03 (pages 2100-122 - 2100-136), are: first, there must be some suggestion or motivation, either in the reference themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference to combine the teachings; second, there must be a reasonable expectation of success; and, finally, the prior art reference (or references when combined) must teach or suggest all of the claim limitations.

As Tichenor fails to disclose removing the unwanted film from the mask by using oxygen plasma, Sakai fails to suggest or disclose removing the contaminations on the mask, and Dao fails to disclose the occurrence of contaminations inside the exposure apparatus and the removal of contaminations inside the exposure apparatus, the combinations of Tichenor and Sakai, and Tichenor and Dao are improper.

New dependent claim 9 has been added to further complete the scope of the invention to which Applicant is entitled.

In view of the amendments and arguments set forth above, Applicant respectfully requests reconsideration and withdrawal of all the pending rejections.

While the present application is now believed to be in condition for allowance, should the Examiner find some issue to remain unresolved, or should any new issues arise, which could be eliminated through discussions with Applicant's representative, then the Examiner is invited to contact the undersigned by telephone in order that the further prosecution of this application can thereby by expedited.

Respectfully submitted,

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